National Aeronautics and Space Administration

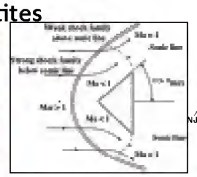
Space Technology Presentation

DARPA Phoenix Industry Day

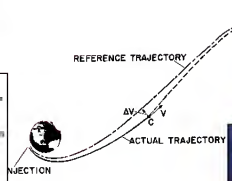
Bruce Yost, Edison Program Manager
John Hines, ARC Center Chief Technologist
NASA Office of the Chief Technologist
November 9, 2011

Tektites

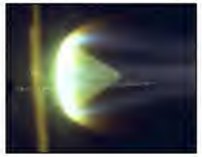
Flight Simulator



Blunt Body Concept

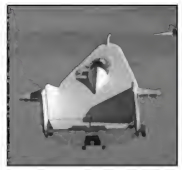


Apollo Guidance System



Apollo Heat Shield Tests

Transonic Flow



Lifting Body

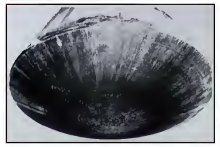
Swept-Back/Wing

Conical Chamber

1940

Flight Research

Life Sciences Research



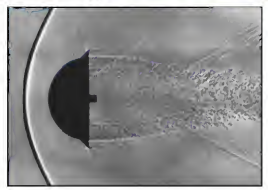
Apollo Re-Entry Shape

1950

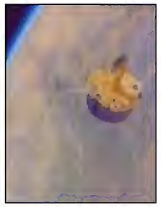
Arcjet Research

1960

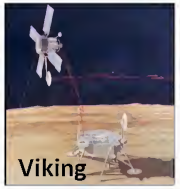
CFD



Hypervelocity Free Flight



Pioneer Venus



Viking

1970

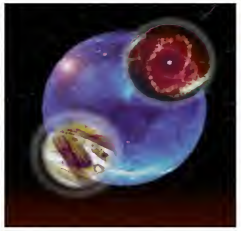
80x120 Wind Tunnel

1980

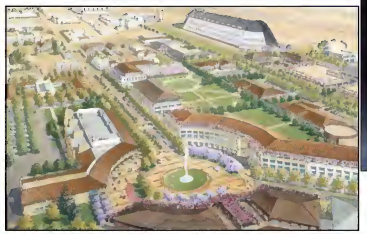
2000

Human Centered Computing

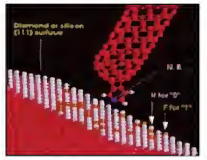
1990



Astrobiology



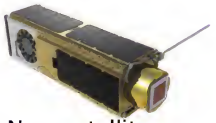
NASA Research Park



Nanotechnology

2010

SOFIA



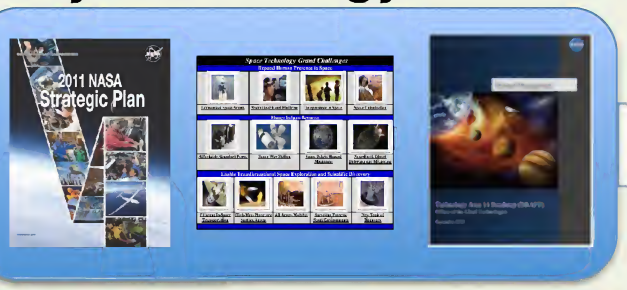
Nanosatellites

Kepler

LCROSS

One of the World's Fastest Operational Supercomputers

Agency Technology Portfolios



Top Down Driven Strategic Guidance

Top Down Driven Strategic Guidance

Identify Intersection Points

Fill Technology Gaps

External Technology Portfolios

DoD

NRL

FAA

NRO

Space Command

DoE

AFRL

DARPA

and Others

ARMD

SMD

HEO

NASA Mission Directorates

OCT Space Technology Portfolios

Early Stage Innovation

Game Changing Technology

Crosscutting Capability Demonstrations

OCT Divisions and Offices

- Strategic Guidance
  - Agency Strategic Plan
  - Grand challenges
  - Technology roadmaps
- Full spectrum of technology programs that provide an infusion path to advance innovative ideas from concept to flight
- Competitive peer-review and selection
  - Competition of ideas building an open community of innovators for the Nation
- Projectized approach to technology development
  - Defined start and end dates
  - Project Managers with full authority and responsibility
  - Project focus in selected set of strategically defined capability areas
- Overarching goal is to re-position NASA on the cutting-edge
  - Technical rigor
  - Pushing the boundaries
  - Take informed risk; when we fail, fail fast and learn in the process
  - Seek disruptive innovation
  - Foster an emerging commercial space industry

OCT - Complete Technology Maturation Pipeline

- Space Technology Research Grants

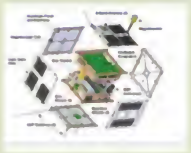
- NASA Innovative Advanced Concepts (NIAC)

- Center Innovation Fund

- Centennial Challenges Prize

- Small Business Innovation Research & Small Business Technology Transfer (SBIR/STTR)

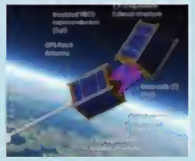
- Game Changing Development



- Franklin Small Satellite Subsystem Technologies

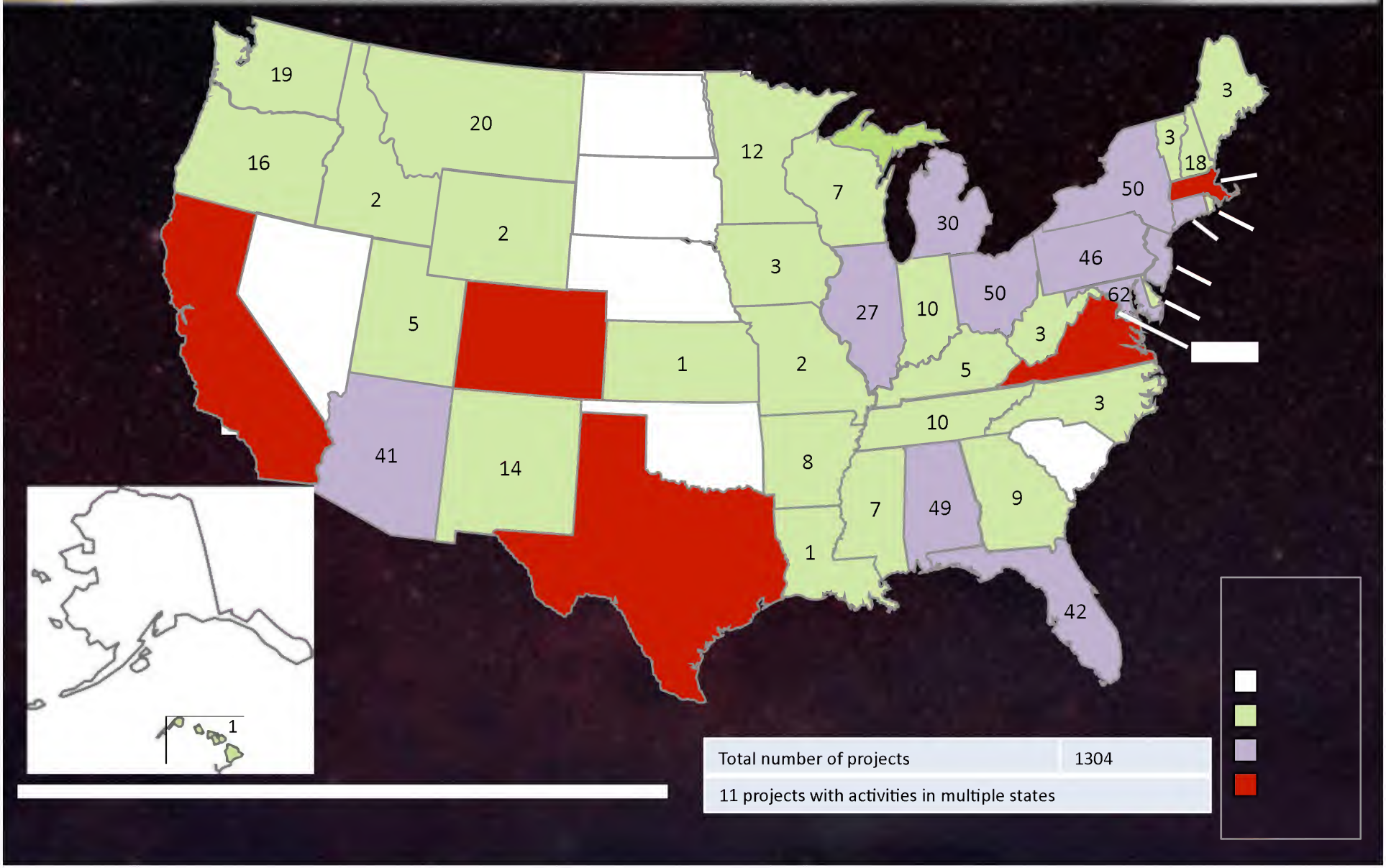
- Flight Opportunities

- Technology Demonstration Missions

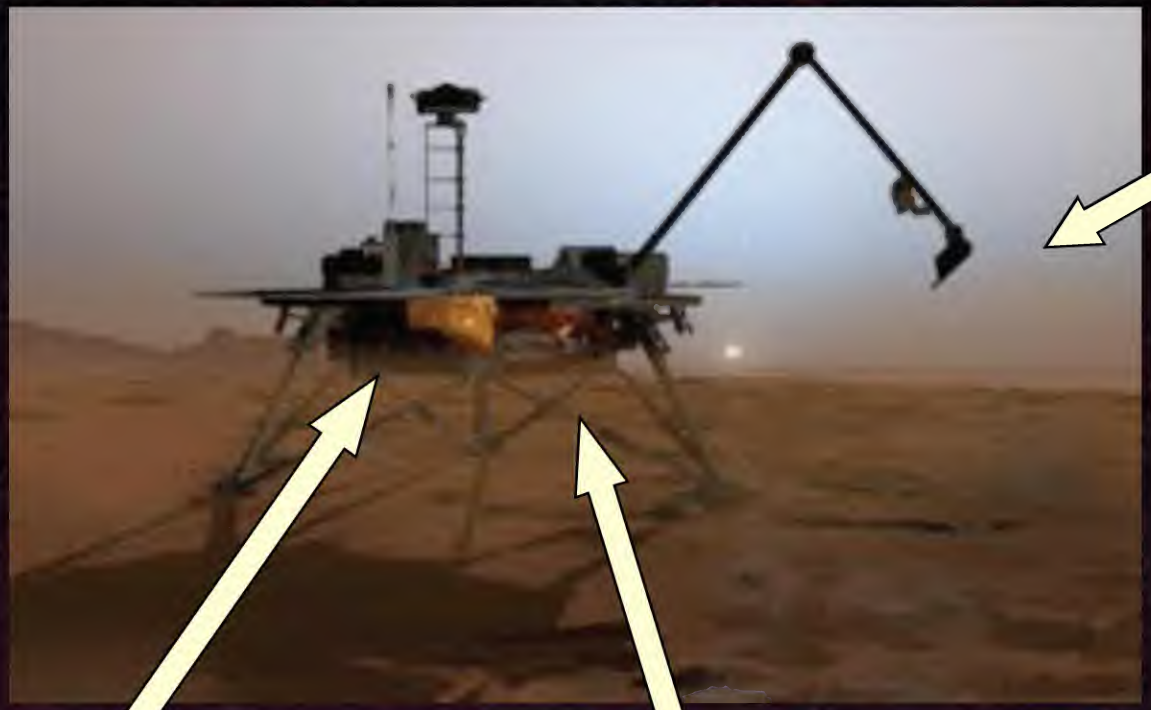


- Edison Small Satellite Demonstration Missions

Total OCT Projects by State



Total number of projects	1304
11 projects with activities in multiple states	



Mars Phoenix Lander

Icy Soil Acquisition Device supplied by Honeybee Robotics, Inc.

Lithium ion batteries supplied by Yardney Technical Products, Inc.

SpaceDev (formerly Starsys) contributed to the design of the Microscopy Electrochemistry and Conductivity Analyzer (MECA)

Totals	FY 2011
SBIR	
Phase 1 Awards	~450
Phase 2 Awards	~216
STTR	
Phase 1 Awards	~45
Phase 2 Awards	~27

- Space Technology consists of hundreds of small projects distributed across the country.
- It also includes a few dozen larger projects in the **Game Changing Development** and **Technology Demonstration Missions** Programs.
- GCD and TDM include nine high-priority, high-visibility, broadly-applicable activities, each of which has major testing milestones in FY 2012 and FY 2013:
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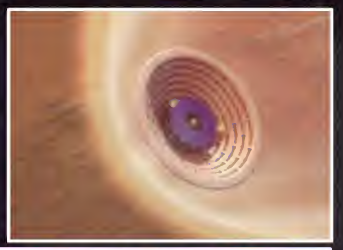
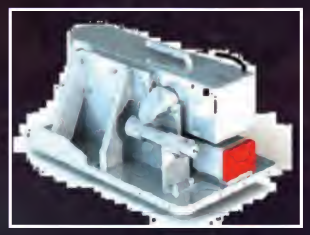
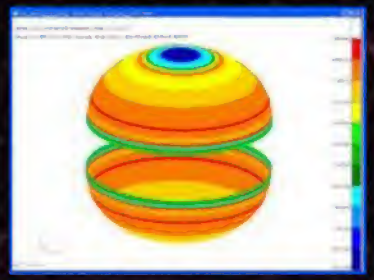
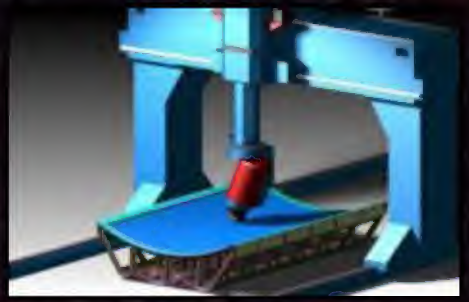
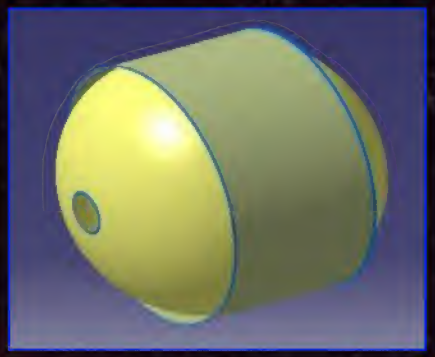
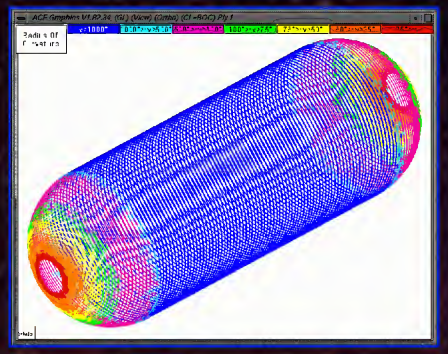
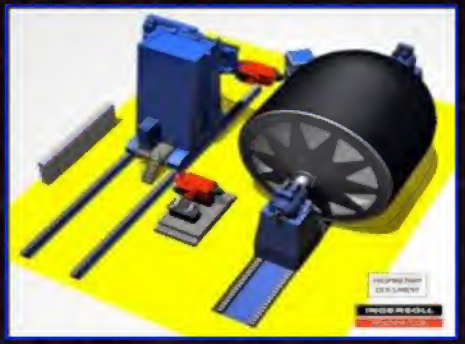



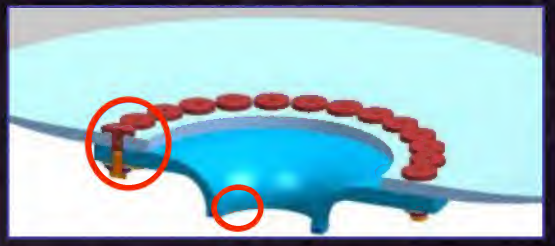







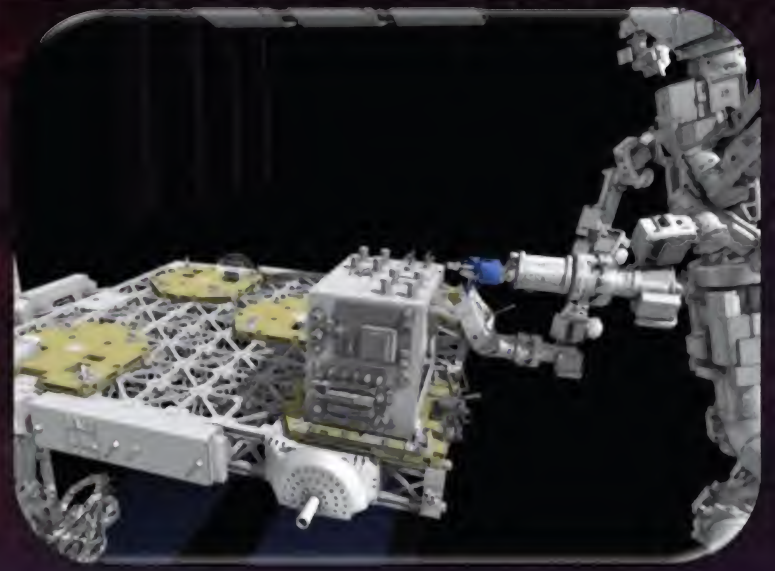




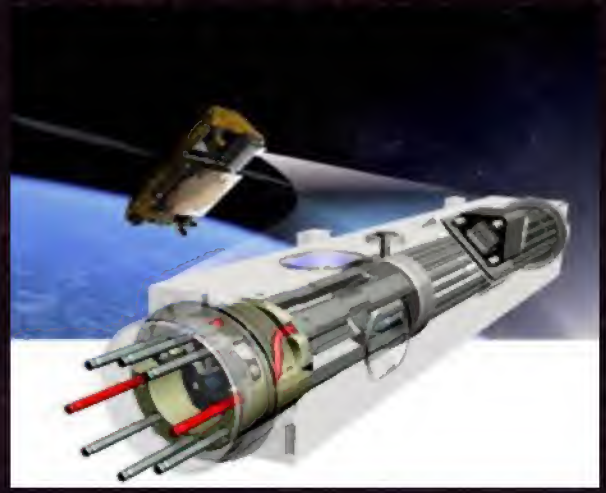


Discontinuity Regions (FOS =2.0)

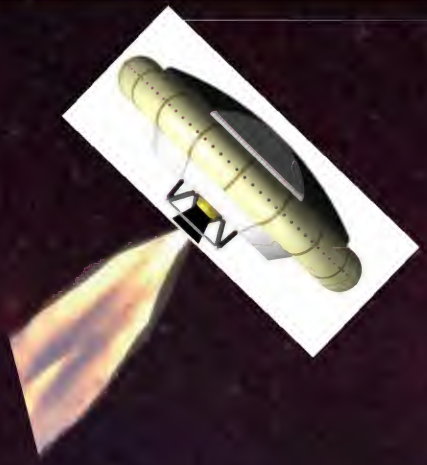
GCD: Satellite Servicing

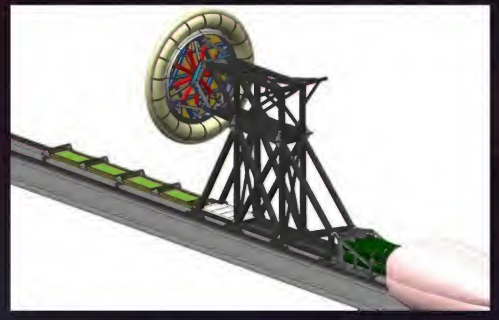


TDM: Laser Communications Relay Demonstration (LCRD)

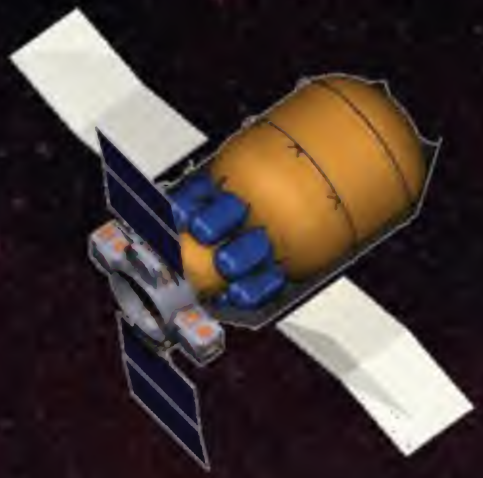


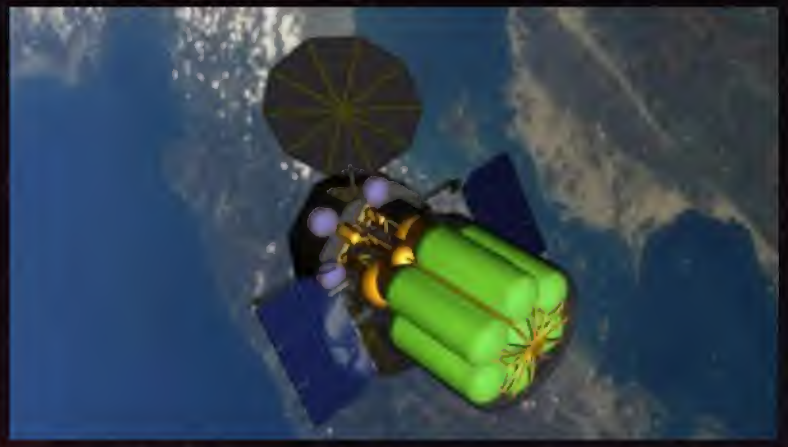
TDM: Low Density Supersonic Decelerator (LDSD)

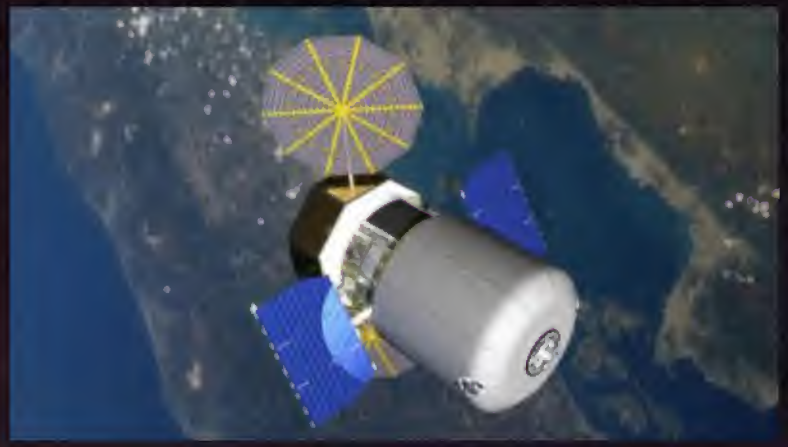


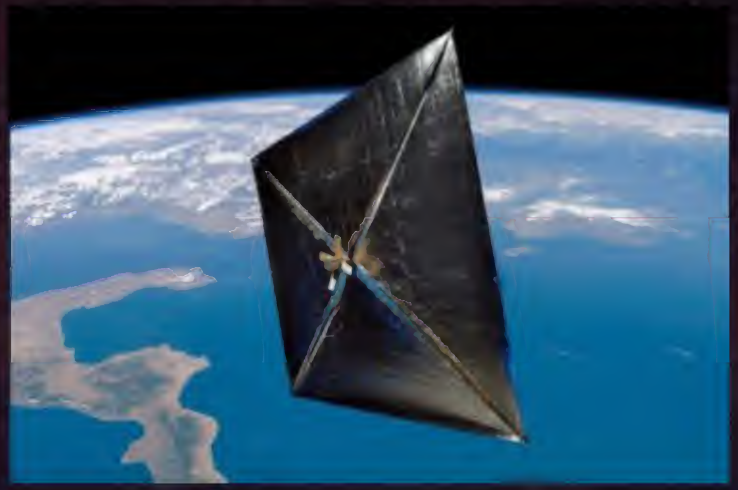


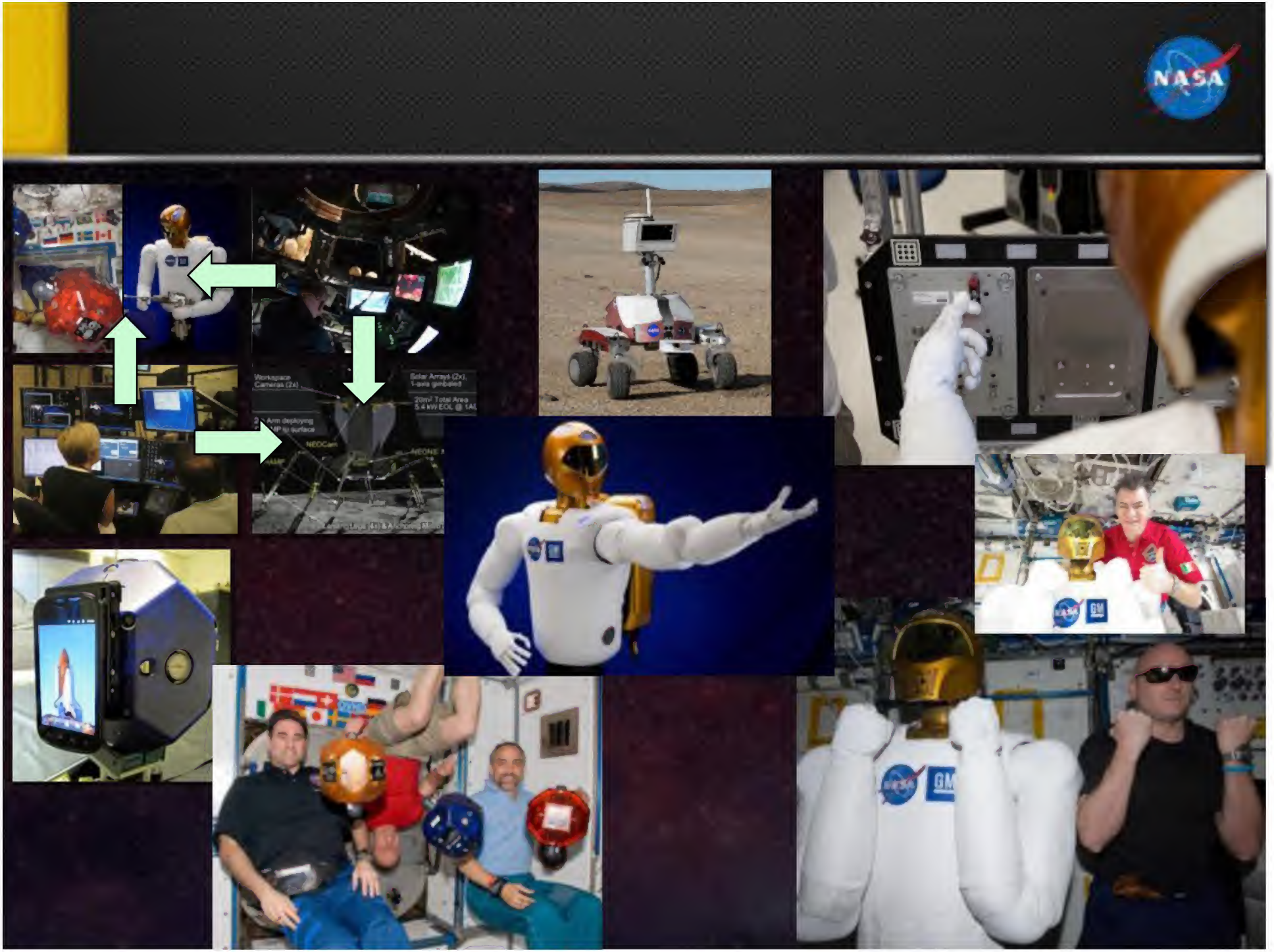
GCD: Hypersonic Inflatable Aerodynamic Decelerators (HIAD)

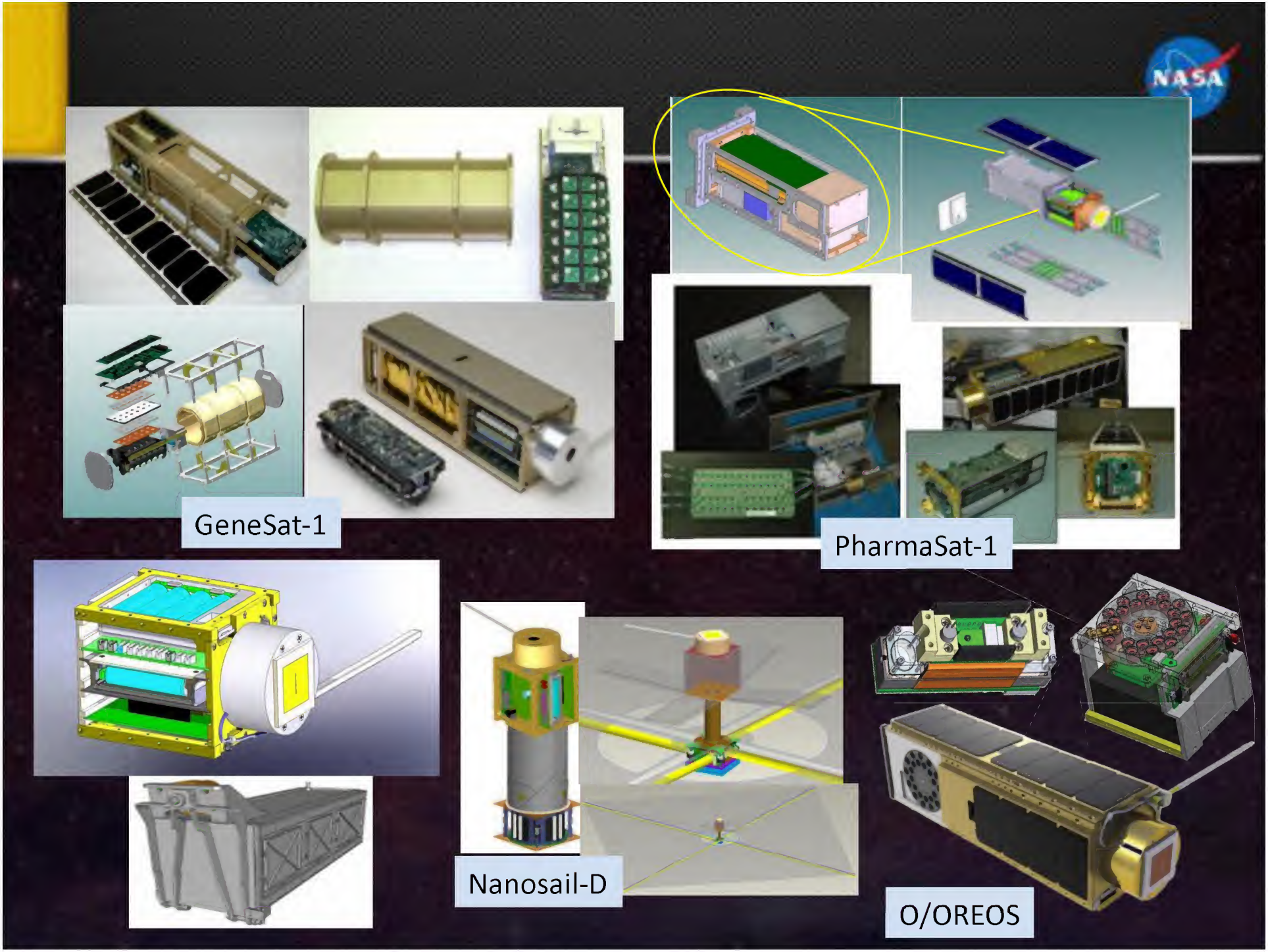


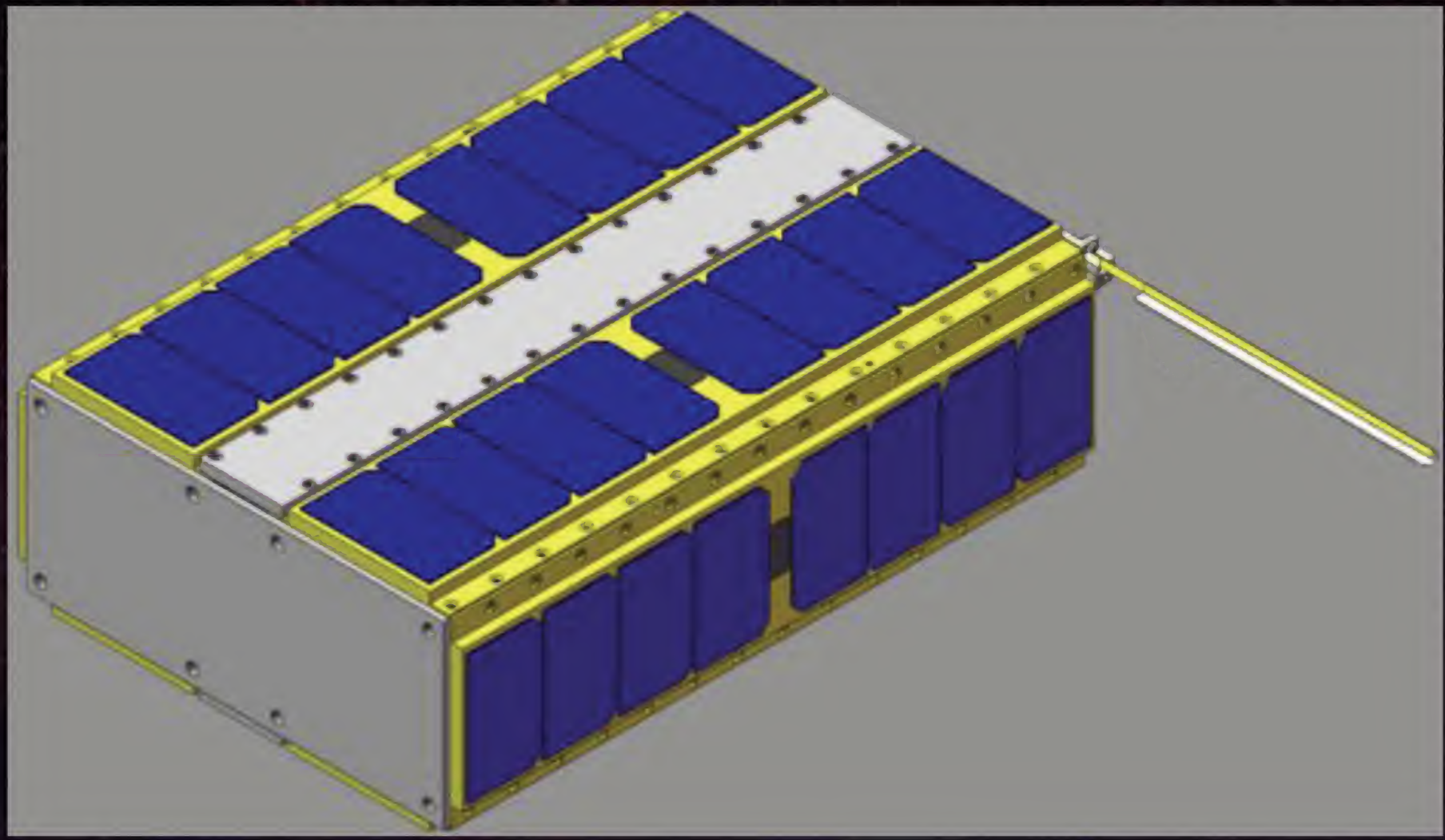






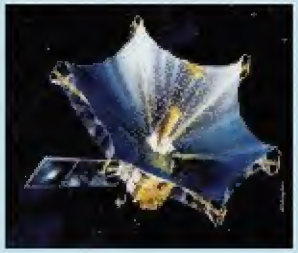

NASA
Workspace Cameras (2x)
Solar Arrays (2x), 1-axis gimbaled
GM


GeneSat-1
PharmaSat-1
Nanosail-D
O/OREOS



Small Spacecraft in the Space Technology Program

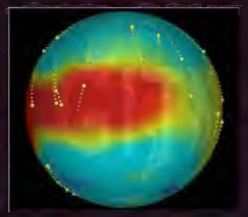
Crosscutting Capabilities

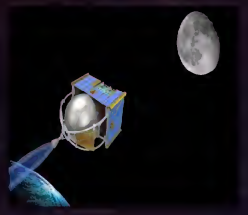


Technology Demonstration Missions

EdisonSmall Satellite Demonstration Missions

Flight Opportunities

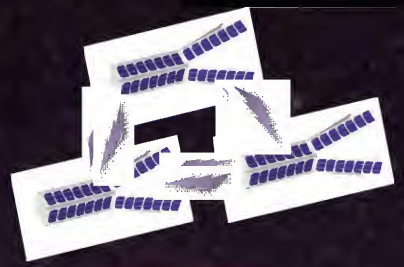
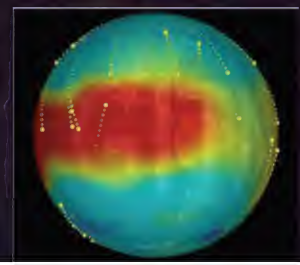




EtherSat Goals

- **Provide a new cost / technology paradigm for spacecraft design**
  - Leverage major investments from telecommunications industry
  - Allow spacecraft missions to be designed in software model
  - Enable rapid refresh of hardware
- **Enable emergent behaviors and applications**
  - Provide open platform with support for application developers
  - Provide crosslinks, downlinks, and timing to support data fusion
  - Provide multiple sensors without immediate application
- **Develop technology to support future operational swarms**
  - Support robust data downlink rate
  - Support payload data processing and compression
  - Provide attitude control, determination, and timing



Planetary Hitch Hiker Goals

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arch